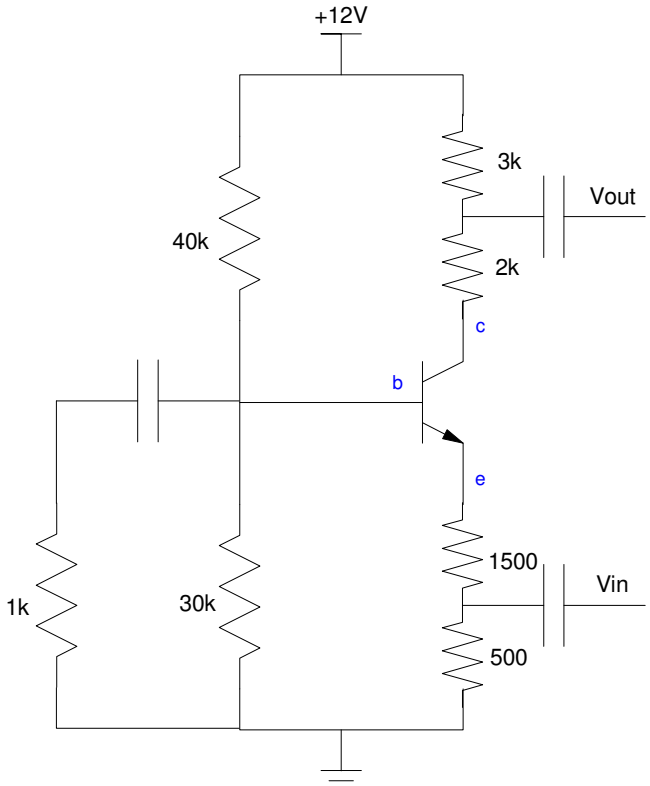
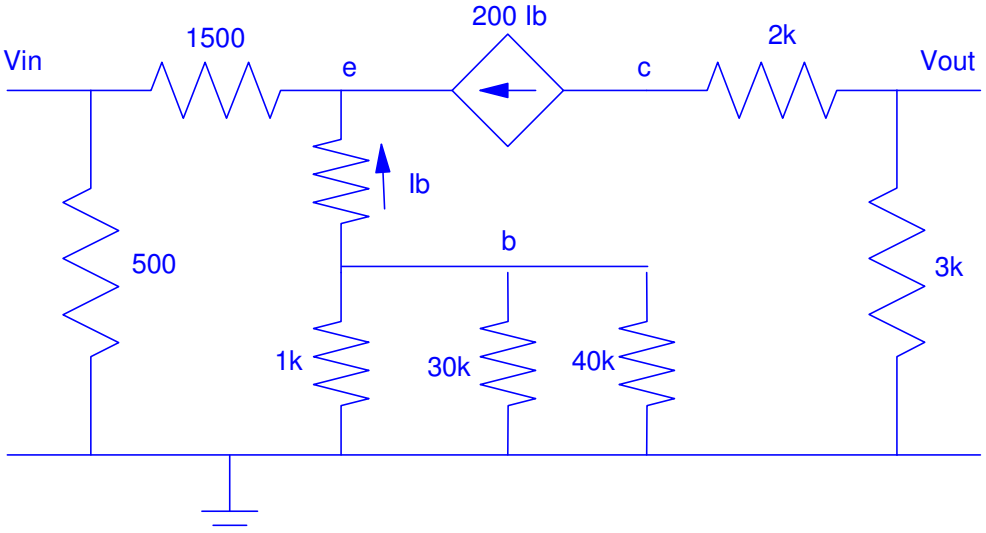
ECE 321 - Quiz #5. Name _____

Common Base, Common Collector Multi-Stage Amplifiers. May 3, 2018

1) Draw the small signal model for the following amplifier. Assume

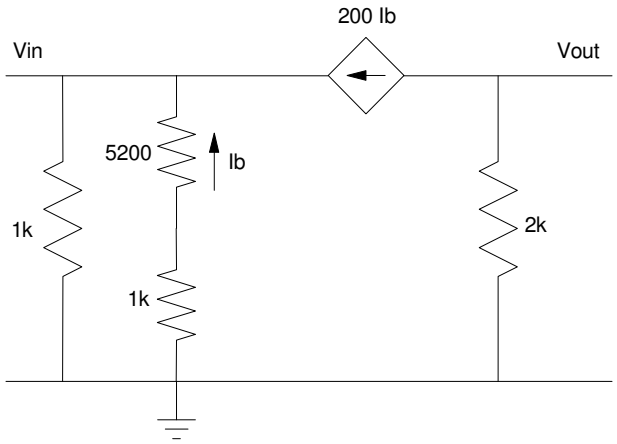
- rf = 5000 Ohms
- β = 200

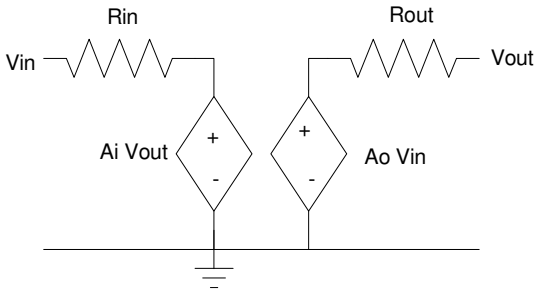




2) Determine the 2-port model for the following circuit.

Rin	Ai	Ao	Rout
29.9	**0**	**64.5**	**2000**





Rin: Short Vout.

Apply 1V to Vin

Measure (comute) the current

$$I_{in} = \frac{1}{1k} + \frac{1}{6200} + \frac{200}{6200}$$

$$I_{in} = 33.4mA$$

$$R_{in} = \frac{1}{I_{in}} = 29.9\Omega$$

Rout: Short Vin.

Apply 1V to Vout

Compute the current Iout

$$I_b = 0$$

$$R_{out} = 2k$$

Ain: Apply 1V to Vout. Compute Vin

Vin = 0 works

Ai = 0

Aout Apply 1V to Vin

Compute Vout

$$I_b = \frac{-1}{6200} = -161\mu A$$

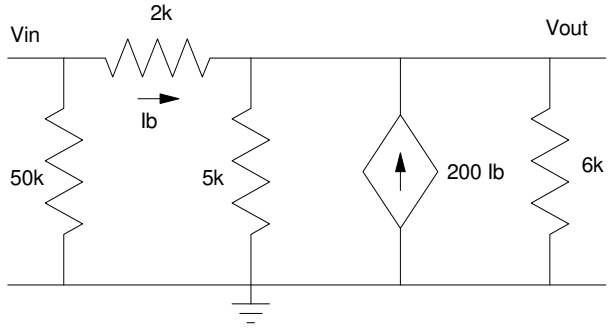
$$200I_b = -32.26mA$$

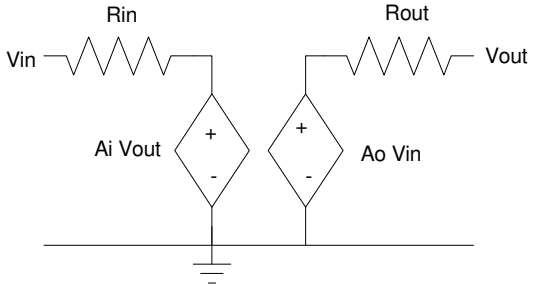
$$V_o = -2k \cdot 200I_b$$

$$V_o = +64.5$$

3) Determine the 2-port model for the following circuit.

Rin	Ai	Ao	Rout
1923	**0.9615**	**0.9964**	**9.91**





Rin: Short Vout

$$R_{in} = 50k||2k$$

$$R_{in} = 1923$$

Rout: Short Vin

Apply 1V to Vout. Compute Iout

$$I_{out} = \frac{1}{2k} + \frac{1}{5k} + \frac{200}{2k} + \frac{1}{6k}$$

$$I_{out} = 100.9mA$$

$$R_{out} = \frac{1}{I_{out}} = 9.91\Omega$$

Ai: Apply 1V to Vout. Compute Vin

$$V_{in} = \left(\frac{50k}{50k+2k}\right)$$

$$V_{in} = 0.9615$$

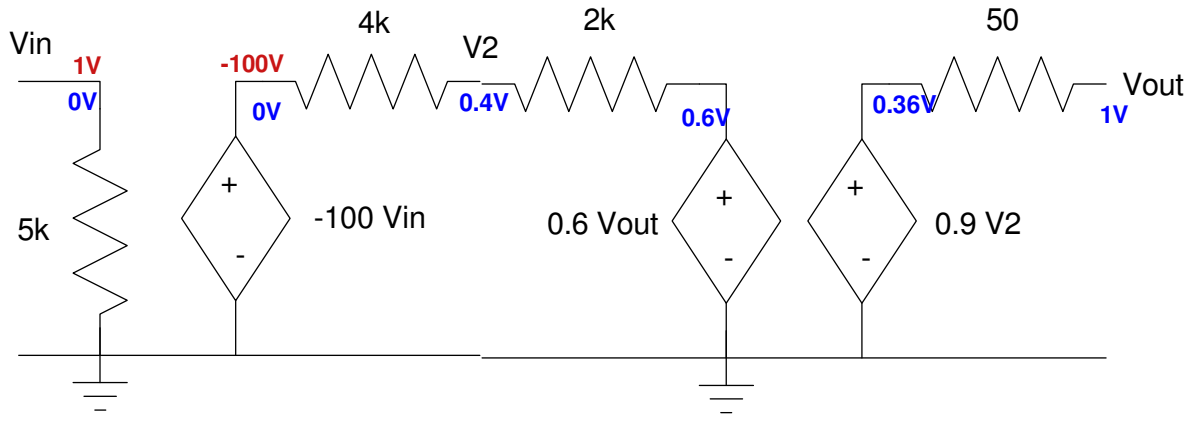
Ao: Apply 1V to Vin. Compute Vout

$$\left(\frac{V_o - 1}{2k}\right) + \left(\frac{V_o}{5k}\right) + 200\left(\frac{V_o - 1}{2k}\right) + \left(\frac{V_o}{6k}\right) = 0$$

$$V_o = 0.9964$$

4) Determine the 2-port model for the following circuit

Rin	Ai	Ao	Rout
5k	**0**	**-46.87**	**78.12**



By inspection, looking in on the left all you see is a 5k resistor:

- Rin = 5k
- Ai = 0

Ao: Apply 1V to Vin. Compute Vout (red numbers)

$$\left(\frac{V_2-(-100)}{4k}\right)+\left(\frac{V_2-0.6V_o}{2k}\right)=0$$

$$\left(\frac{V_2+100}{4k}\right)+\left(\frac{V_2-0.6\cdot 0.9\cdot V_2}{2k}\right)=0$$

$$V_2=-52.08$$

$$V_o=0.9V_2=-46.87$$

Ro: Short Vin. Apply 1V to Vout. Computer Iout (blue numbers)

$$\left(\frac{V_2-0}{4k}\right)+\left(\frac{V_2-0.6}{2k}\right)=0$$

$$V_2=0.4V$$

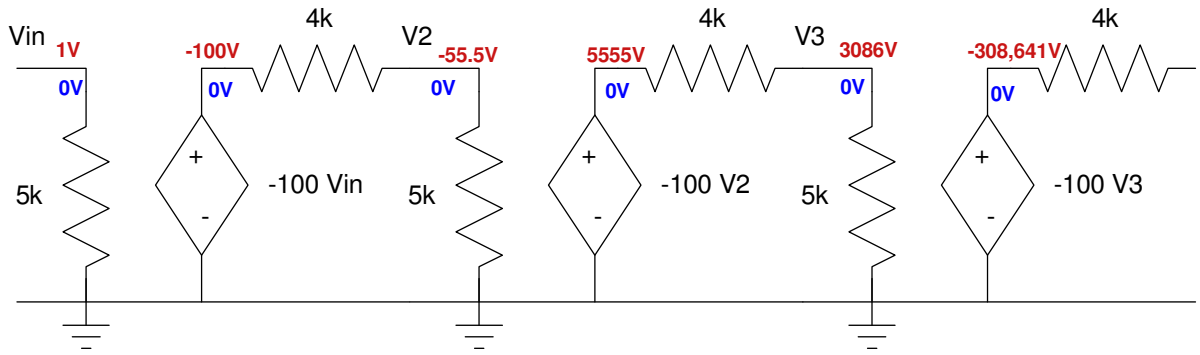
$$0.9V_2=0.36V$$

$$I_{out}=\left(\frac{1-0.36}{50}\right)=12.8mA$$

$$R_{out}=\frac{1}{I_{out}}=78.12\Omega$$

5) Determine the 2-port model for the following circuit

Rin	Ai	Ao	Rout
5k	**0**	**-308,641**	**4k**



By inspection, looking in on the left all you see is a 5k resistor

Rin = 5k

Ai = 0

Rout: Short Vin. This zeros out everything (blue numbers) so all you see at the output is 4k to ground

Rout = 4k

Ao: Apply 1V at the input. Compute the voltage at the output (red numbers)

$$V_{in} = 1V$$

$$-100V_{in} = -100V$$

$$V_2 = \left(\frac{5k}{5k+4k}\right)(-100V) = -55.5V$$

$$-100V_2 = 5555V$$

$$V_3 = \left(\frac{5k}{5k+4k}\right)(5555V) = 3086V$$

$$100V_3 = -308,641$$

Bernie vs. Godzilla Bonus!! Bernie Sanders likes cheese. He doesn't like 200 foot tall monsters stomping upstate Vermont. Three of the following are Godzilla monsters and three are types of cheese. Which are cheese?

Ayibe **Dorat** Garuda Kefalotyri **Mondseer** **Shockirus**